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ABSTRACT

Experiments in teaching language or language-like behavior to chimpanzees and other primates may bear on the problem of the origin of language. Evidence appears to support the theory that man's first language was gestural. Recent pongid language experiments suggest: (1) a capacity for language is not solely human and therefore does not represent the human end of a basic biological discontinuity; and (2) since chimpanzee experiments have involved manual language, perhaps early human language also employed gestural signs. Early Greek, Roman, Moslem and Christian writings supposed language to be a gift from various gods. Descartes saw language as the distinction between man and animals. During the 17th and 18th centuries the debate continued as Europeans learned more about chimpanzees and apes. The 1859 publication of Darwin's "Origin of Species" rekindled the debate, among such writers as Thomas Huxley, Edward B. Tylor and Wilhelm Wundt. In this century primate experiments with manual and vocal language were begun. The experiments of the Gardners, Premack, Rumbaugh and Fouts with chimpanzees demonstrate language abilities in these animals. Molecular biology shows a close link between man and chimpanzees, but experiments do not explain how human language developed beyond the apes to vocal-auditory language. (CHK)

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Chicago, 30 August, 1975, APA Meeting

Symposium: CHIMPANZEES AND SIGN LANGUAGE: IMPLICATIONS AND PERSPECTIVES

"THE EVOLUTIONARY SIGNIFICANCE OF PONGID SIGN LANGUAGE ACQUISITION"

by Gordon W. Hewes, Department of Anthropology, University of Colorado, Boulder

"En un mot serait-il absolument impossible d'apprendre une langage à cet animal ? Je ne crois pas. Je prendrais le grand singe préférablement à tout autre ... "

Julien Onffray de la Mettrie, 1748.

This symposium arises from the successes of R. Allen Gardner and Beatrice T. Gardner, and others, in inculcating language or language-like behavior in chimpanzees. There have been somewhat less successful efforts to develop language in gorilla and orang-utan. Others on this panel will discuss these efforts from the standpoint of research methods, possible biological constraints, comparisons with language acquisition in human children, and the sign language vehicle. To anticipate my main point, I believe these experiments have a bearing on the long-standing problem of the origin of language, and support the old theory that man's first language was not vocal, but gestural. Additionally, these experiments present major philosophical implications, which go back to René Descartes and his followers in the 17th century, and to some extent back to the earliest serious thinking about the nature of language, and its relation to man's place in nature. I hope you will forgive my long detour into the controversies of the 17th and 18th centuries.

Although as we shall see, the great apes or Pongidae, stand closer to mankind than any other animals, only man possesses language, and until recently, it seemed that man was the only creature capable of acquiring language. For Descartes, it was language which sets us apart from the beasts, seemingly confirming the doctrine of man's special creation, as set forth in Genesis. Much of the current opposition to the interpretations of the work of the Gardners, Premack, Fouts, Rumbaugh, et al., can be viewed as a persistence of Cartesianism.

Discussions such as this usually begin with definitions of language, but to save time I shall simply refer you to E. von Glasersfeld (1974) for a good treatment of this matter. Fortunately, individuals with considerable standing in your discipline - D.O. Hebb (1973) and Harry Harlow (1973) - agree that the Gardners, Premack, et al. have succeeded in developing language of some sort in anthropoid apes. Fewer linguists, and regretfully, perhaps still fewer anthropologists have been willing to concede this, although some of us have been quite

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willing to stipulate that language has been achieved (Hewes, 1973). Unnecessary confusion has arisen in some quarters on the ground that the only "real languages" are vocal, but Professor William Stokoe should be able to dispel this objection, at least as it relates to ASL or Ameslan, the sign language current in a sizeable portion of the American deaf community.

The recent pongid language experiments raise major questions which fall under two headings, general and specific, viz.:

I. First, they suggest that a capacity for language is not a human monopoly, and hence, language does not represent the human end of a basic biological discontinuity. If a human propensity for language is not entirely genetically pre-programmed, just what, if anything, is innate about our language capacity ? Is it possibly mainly or even wholly a matter of the vocal-auditory channel ? If animals such as chimpanzees, with brains about one third or less the size of human brains, can acquire what some of us consider to be rudimentary language, what can this tell us about the language-acquisition capacities of the fossil forerunners of our species, and in particular, of the Australopithecines of two or three million years ago, who, although bipedal and incipiently engaged in stone tool-using, had brains not significantly larger than modern Pongidae ?

II. Second, since some of the chimpanzee language experiments have involved a manual sign language, is it possible that the earliest form of human propositional language employed gestural signs rather than vocal sounds ? This notion is very old, and has been seriously debated in previous centuries. Is it possible that the recent chimpanzee language experiments provide us with empirical data for a gestural model of early glottogenesis ?

Curious as it may seem, the impetus for the present pongid language experiments which began in the late 1960's did not come from language-origin sepculation, and the original investigators were, I think, careful not to invest their work with such a theoretical justification. Nevertheless, their work came just at the time that the Zeitgeist in several fields was ready for empirical data relating to this ancient problem. As we shall see, physical anthropology for a decade and a half preceding the Gardners' and Premack's studies had been developing a new hominization model, based on unexpectedly rich fossil discoveries in Africa, new and quite reliable geochronological frameworks, and more firsthand field observation of primate behavior than had been undertaken throughout the previous century - that is, back to the time of Darwin's Origin of Species in 1859. Moreover, following Noam Chomsky's devastating review of B.F. Skinner's magnum opus on verbal behavior (1957), there had been a major revolution in linguistics,which proved to have an unavoidable effect on glottogonic speculation, dormant for many

decades in respectable linguistic circles. With Chomsky's notions of the species-specific and innate character of human language capacity, paleoanthropologists engaged in constructing new human evolutionary models were bound to reopen the question of when and under what conditions human language emerged. We are all familiar with the explosive growth of interest in child language acquisition during this same period, in the revival of cognitive psychology, in the rediscovery of the work of Jean Piaget, and at the same time, of major advances in neurology. Whether they planned for it or not, the investigators of chimpanzee language capacities could not avoid finding that their work was of sudden and immense interest to workers in several other disciplines, concerned among other things with the origin and evolution of language.

Thus, what we are discussing in this Symposium is also the subject of a much larger conference, sponsored by the New York Academy of Sciences, to be held from September 22 to 25, with over eighty participants, on the origins and evolution of language and speech. The New York affair will unquestionably be the largest scientific gathering ever held to deal with this topic, and, surprisingly enough, the first time since 1769-1770, that a reputable Academy of Science has deigned to host such an undertaking. In 1769 the Royal Prussian Academy of Sciences in Berlin sponsored, not a face-to-face meeting, but an essay competition on the origin of language, which attracted 31 entrants from several countries. I have not been able to find any record of a comparable event between 1770 and now, save for some small symposia like this within the last five years. Indeed, in 1866, the prestigious Société de Linguistique de Paris forbade the presentation of any papers dealing with language origins - a rule which has not yet been rescinded. The chimpanzee language studies, therefore, did coincide with a Zeitgeist readiness to reopen the long-taboo question of mankind came to have language. It was not simple coincidence that Roger W. Wescott, a linguist, came forth in 1967 with a paper entitled, "The evolution of language: re-opening a closed subject". At that very moment, the Gardners were compiling their early mimeographed protocols on the sign-language achievements of their infant chimpanzee, Washoe, and David Premack had just published his hypothetical paper (with Arthur Schwartz), entitled "Preparation for discussing behaviorism with chimpanzee"(1966). That year also saw the publication of Eric H. Lenneberg's Biological foundations of language.

The question of how language came into being is embedded in numerous myths, although it happens that the one most familiar to us, in Genesis, is one of the most explicit, and has certainly been the most productive of exegetical debate. The ancient Greeks, not committed to the Bible, were freer to speculate about

glottogenesis, but the topic was not, in fact, a matter of very great concern for most Classical writers. In Plato's Cratylus Dialogue, the issue was not so much how language might have originated, but rather whether words were wholly arbitrary with respect to their referents, or reflected some natural connection. The Epicureans favored a natural origin of language, arising from human intelligence and social needs, and this was the position of the Roman Epicurean poet, Lucretius, in the first century B.C. Other Greeks and Romans supposed that language was simply a gift of the Gods. Herodotus, in his account of Egypt, related the tale of King Psammetichus, who ordered two infants isolated and without outside access to language, in order to determine which language was most ancient (it was concluded to be Phrygian, a language of Asia Minor). We shall have occasion to make later reference to this as the "Psammetichus Experiment", since the project has come up several times since.

The early Christian writers followed Jewish Biblical teaching, to the effect that language was God-given to Adam in the Garden of Eden, and usually, further, that it was the Hebrew language. Presumably, Hebrew survived as one of the supposed seventy-two tongues produced by the Confusion at Babel by the outraged Deity. The Muslims offered only a slightly different version, in which the primordial language, not surprisingly, was Arabic rather than Hebrew. Although interesting thoughts about language occur in the Patristic and Talmudic literature, and on into the eras of Scholasticism and the Renaissance, for example, in St. Augustine, who wrote about how he, as an infant, acquired language, starting with gestures, the fact is that really independent and creative thinking about language origins did not appear until the 17th century.

Aside from the worldwide voyages of the 16th century, which raised some serious doubts about the Tower of Babel story in respect to the diversity of languages ndapeoples, and the possibility of "Pre-Adamite" peoples, orthodoxy generally prevailed. What was of relevance to this paper was a genre of writings in praise of animals, contrasting their virtues with the failings of mankind. George Boas, an American historian of ideas, coined the term "theriophily" for these views (1933; 1973:384). The best-known of the theriophiles was Michel de Montaigne. For a long time the pro-animal/anti-animal debate did not involve language matters, but that changed with René Descartes, who chose to side with the anti-theriophiles in his Discours sur le Méthode (1637;cf.1952 ed.,transl.). Much of this 17th century debate might be intellectually obsolete, had not Noam Chomsky seen fit to base his linguistic revolution on a revival of Cartesianism, and the writings of the grammarians of the Abbey of Port-Royal.

For Descartes, language was the vera differentia between man and beast. First, he shows that the bodies of both man and animal are merely machines, or

automata (Discours, 1952 ed., pp.59-60). Were it possible to construct an automaton in the form of a monkey, he wrote, "or some other animal without reason", we should be unable to distinguish it from a live animal. But a machine built in the shape of a man could be so distinguished from a real man, because it could never "use speech or other signs as we do when placing our thoughts on record for the benefit of others." Even human idots can arrange words and make their thoughts public, and, significantly, the deaf and dumb can make themselves understood by means of sign-language. Deseartes reiterated these arguments in letters to some who doubted the great gulf which was thus placed between man and beast - to the Marquis of Newcastle in 1646, and to the English philosopher, Henry More (not to be confused with Thomas More, a century earlier!). When words are taught to parrots or magpies, Descartes explained, they do not constitute language. Monkeys, he said, can be trained to do various tasks, "without any thought at all". "There has never yet been found a brute so perfect that it has made use of a sign to inform other animals of something which had no relation to their passions"(cf.Vendler,1972:153). Yet Henry More was not convinced that dogs, for example, barked without having any "interior sentiments". For Descartes, "the word is the sole sign and the only certain mark of the presence of thought wrapped up in the body."

Descartes was not merely to deny language to beasts, but to thus demonstrate that their lack of language implied lack of reason and feelings, and hence also immortal souls. He did not insist that the language usable in such a test had to be a "natural language", admitting not only the sign-language of the deaf, but by implication, a new and perfect artificial language, which was a project he found attractive along with a number of other 17th century intellectual figures, including Bishop Wilkins (who actually constructed such a language system), Isaac Newton, and Gottfried Wilhelm von Leibniz. Thus, in arguments with some Neo-Cartesians, we have the authority of Descartes himself for the legitimacy of not only a language such as ASL (Ameslan), but even of Yerkish, the artificial but logically consistent idiom devised for the chimpanzee Lana by Rumbaugh and his colleagues.

The most competent critic of Descartes in the 17th century was Pierre Gassendi (Disquisitio Metaphysica, Meditationem II, Dubitatio VI, 1962 ed.) who argued that it was not fair to demand of beasts that they should exhibit the speech of mankind, not taking into account that which is proper to them. Unfortunately Gassendi breaks off that line of argument, saying, "But that would be the subject of a long discussion". The much more widely read Cartesian Discours had many devoted defenders, notably Malebranche and Bossuet (cf.Boas,1933).

Presumably unaware of these weighty arguments, Samuel Pepys, the diarist,

went to see a large baboon or possibly a chimpanzee brought back from Angola by an English captain in London, and he wondered if the beast, which seemed very intelligent, might not be taught to speak, or perhaps communicate "by signs". Pepys was not a layman in matters scientific of the time, and later on, served as the Secretary of the Royal Society.

Until about 1750, Cartesianism underwent a decline (Hastings, 1936:22). Some commentators, indeed, saw that if carried to its logical conclusions, it would lead straight to materialism. The beast-machine debate, as it came to be called, continued to attract intellectual attention, and Hester Hastings has provided a lengthy tabulation of the 18th century writers who held one or another of the several opinions on the matter (1936:63,Tab.38),for by now there were more than just two views. Bouillier,for example, recognized a "language of gestures and cries" in animals; Voltaire regarded animal cries as a less perfect form of language. Bougeant claimed that animals had their own languages (1739). More important, Bernard de Mandeville in England, and the Abbe de Condillac and Pierre Louis Moreau de Maupertuis in France, were suggesting that man, unaided by God, could create language, specifically beginning with pointing and gestures, supplemented by passionate cries. Condillac was careful, to be sure, to make it clear that language had in fact been a Divine gift, as related in Genesis, and that man's capacity to re-create language if left to his own devices (for example, if two children were abandoned before learning to speak) was a hypothetical possibility.

Knowledge of anthropoid apes was also increasing. A few specimens of East Indian orang-utans or African chimpanzees had reached Europe and had been studied and dissected, but in 1699 the English anatomist Edward Tyson published the results of his dissection of an "oran-outang, or Pygmy", which his carefully drawn illustrations show to have been in fact a very young chimpanzee. Tyson was struck by the close resemblance of this animal to man, including its brain and vocal organs, and wondered why it might not be able to speak. Among the tales then circulating about these manlike apes was one which claimed that these "men of the woods" did have the power of speech in their native forests, but pretended to be mute so as to avoid being enslaved. At any rate, it was with such knowledge of the anthropoid apes (gorillas were not yet known to Europeans) that Julien Onffray de la Mettrie wrote his anti-Cartesian tract, L'Homme machine, in 1747-48, in which he asserts his belief that such apes could be taught language. He had already briefly mentioned this possibility in his Histoire naturelle de l'âme, 1745, and he had by then also learned about the successful methods of teaching born deaf persons to speak set forth by Jan Coenrad Amman, in a book called Surdus loquens (the Speaking Deafman). Even though de la Mettrie felt that apes could acquire spoken language, he recommended that they should be taught by someone

familiar with the problems of teaching the deaf to speak. Thus instructed, the ape, clearly a chimpanzee from Africa, would become a "perfect little gentleman". De la Mettrie was persecuted for this essay, and even in the liberal Netherlands found no asylum. Aram Vartanian has edited the critical edition of L'Homme machine (1960),where he assures us in a footnote that no such experiment could possibly succeed (cf.also Gunderson,Keith,"Descartes, LeMettrie, language and machines," 1964). The deaf were not generally believed to be capable of full human understanding at this time, so that de la Mettrie's plan to employ a teacher of the deaf was in itself an unusual and cobtroversial suggestion.

A few years later, Jean-Jacques Rousseau, in his famous Essai sur l'origine et les fondements de l'inegalité parmi les hommes, 1755, also known as his Second Discourse, wrote that orang-utans (i.e., anthropoid apes, including chimpanzees) were true men, lost in the woods - degenerate human beings who had failed to undergo the influences of the environment which had developed their brothers in ordinary human beings (Oeuvres complètes, 1826 ed.,I:367). Rousseau went on to say that language is not really natural to mankind, even though the speech organs are natural (ibid.,p.370). Yet language, while only conventional, has enabled man to progress.

Valmont de Bomare, 1764, discussed both anthropoid apes and the then popular topic of feral children, but said that only the latter possessed "perfectability" and speech capability (Megill,A.,1974:420,f.n. 37). In 1765 Charles Bonnet defends the apes, though recognizing their inability to speak, but at the same time stating that their brains cannot be very different from ours. Bonnet, about the same time, recommended that there should be detailed research on the apes, comparable to that already devoted to human anatomy, and the anatomy of domestic animals (Hastings, 1936:127). In view of these pro-pongid arguments, it is surprising that the great 18th century naturalist, G. L. LeClerc de Buffon should deny language to the apes not only on the basis of vocal tract deficiencies, but on the theological ground that language is a Divine gift peculiarly vouchsafed to mankind alone - "Nothing proves better that it is a special gift, and made to man alone, since the orang-outang who neither speaks nor thinks, has nevertheless the body, the limbs, the senses, the brain, and the tongue entirely similar to man's; he /the ape/ can make or counterfeit all the movements, all the human actions, yet cannot perform any human act," (cf.Hastings, 1936:125).

In the famous essay contest set in 1769 by the Berlin Academy, Entrant No.3 discussed monkeys and apes, suggesting that if the "orang-outang" were taught speech, it would have difficulty with nasal sounds and would not achieve fluency (Megill,A.,1974:385). Entrant No.6 also considered the "orang-outang", and ob-

served that if the anatomists could not discover anything preventing speech in that animal, they must have overlooked something (ibid.). Entrant No.5 commented that apes could imitate human gestures, but that their manifest inability to speak results from an anatomical deficiency so far undetected by anatomists. Yet, in 1766, Peter Süssmilch asserted that the lack of language in apes lay in their minds, and not in their vocal organs (Megill, 1974:329), adding in the Cartesian spirit that without language, there could be no real mind ("ohne Sprache, keine Vernunft").

The Academy prize was won by Johann Gottfried Herder, whose essay begins with the sentence, "Schon als Tier hat der Mensch Sprache" (Already as an animal, mankind has language). Herder's essay, while asserting that in a state of nature, man employed animal cries and gestures, did not approach the problem in an evolutiionary manner; it kept to the question as formu,ated by the Academy: could man, unaided except by his built-in reason, independently create language ? (Herder,in Heintel, E.,1960; cf. Salmon, P., 1968:59).

In a history of the island of Jamaica, where there are no apes, Edward Long remarked in 1774 that orang-utans might possess sufficient intelligence for the acquisition of language, and even exceed some human groups in linguistic performance. James Burnett, Lord Monboddo, an eccentric Scottish justice, had issued the first volume of his 6-volume treatise on the Origin and Progress of Language in 1773, in which he held that"orang-outangs" (i.e.,chimpanzees) might be taught to speak, and that language had arisen quite naturally, not by divine fiat, in a human stock descended from ape-like ancestors. Herder translated a part of Monboddo's work into German, which was published at Riga in 1784 (cf.Frank E. Manuel, 1968:6), but he rejected Monboddo's ideas, writing in his Ideen zur Philosophie der Geschichte der Menschheit (1784-85),"I could wish that the affinity of man to the ape had never been urged so far, as to overlook, while seeking a scale of Being, the actual steps and intervals, without which no scale can exist." Herder was referring to the concept of the Great Chain (or Scale) of Being, a pre-evolutionary notion, which Arthur Lovejoy dealt with at length in a famous contribution to the history of ideas. Herder's rejection of the possibility of apes learning to talk was based in part on Pieter Camper's then recent anatomical findings, published in 1779, showing that the vocal organs of the East Indian orang-utan were incapable of articulate speech (Salmon, 1968:69). Camper's work was translated into French in 1799, and may have dampened the hope that apes could be taught vocal language. Yet, Joseph Ritson, in an obscure book advocating vegetarianism in 1802, discussed anthropoid apes at length and in a fairly informed fashion for the time, reviving the notion that they might be degenerate human beings, and that mankind had descended from "at least an animal of the same family,

and very nearly resembling it". Like Rousseau, Rotson argued that language was no more natural to mankind than it is to monkeys or parrots (quoted in Hastings, 1936:130).

Speculations about language origins, feral children, and sign language were major concerns of the circle of French intellectuals known as the Idéologues, around 1800, who founded the short-lived Société des Observateurs de l'Homme. Members included the famous teacher of the deaf, the Abbé Sicard, and Jean Marc Gaspard Itard, the teacher of the wild boy of Aveyron, Victor. Another idéologue was Joseph Marie Degérando, who wrote on semiotics (On signs and the art of thinking, 1800) and much later, in 1827, on the education of the born deaf . In the ambitious scientific program of the Société des Observateurs de l'Homme, a large-scale replication of the Psammetichus Experiment was proposed, along with a systematic, worldwide collection of data on sign-language systems. Academic politics connected with Napoleon's assumption of imperial power in 1804 stifled the Society's activities. Georges Cuvier, who had been associated with the idéologues, made some observations of a live orang-utan, along with careful dissections, which convinced him that although the animal was highly intelligent in many ways, it was incapable of language, around 1810 (Hastings, 1936).

During the Romantic Period, roughly until mid-century, language origin speculation was at a low ebb, not reviving until Ernest Renan published on the topic in 1848, although Pierquin de Gembloux, in a work on the "language of animals" issued in 1844 had suggested that animal cries and calls might shed light on human language beginnings. Why glottogenesis which had been such an intellectual cause célèbre in the 18th century, should have become so uninteresting during the first half of the 19th century is not too much of a mystery. To begin with, there was no new evidence, and most of the theoretical suggestions had already been thought of and extensively debated. Perhaps more important, scholarly interest in language was intense, but focussed on comparative philology, which did provide abundant empirical data and theoretical issues galore. Eventually, to be sure, 19th century philology generated some new approaches to language origin theorizing.

Darwin's publication of Origin of Species in 1859 prodouced an almost immediate reaction among the linguistic scholars of the time. The notion of evolution from simpler ancestral forms through natural selection was soon applied to languages. Darwin himself paid little attention to linguistic evolution, even in his Descent of Man (1871), but others quickly took up the issue. To begin with, there was the question of whether the brain of man contained any structure not also found in the brains of apes, vigorously debated in the early 'sixties by Thomas H. Huxley in his defense of Darwin. Paul Broca communicated his discovery of the cortical

region which now bears his name, the first "speech area" to be recognized in the human left hemisphere, to the Bulletin de la Société Anthropologique in 1861, since Broca regarded himself more as an anthropologist than a medical investigator. Edward B. Tylor, the pioneer British general anthropologist, reopened the question of feral children and its long association with the problem of man's innate language propensities, in an article in 1863, and took up the question of glottogenesis in 1868. Meanwhile, the hard-pressed Société de Linguistique de Paris enacted its famous statute banning further communications on the subject of language origin in 1866. Unimpressed by the Paris action, Tylor continued writing on the subject, mostly in support of the gestural origin theory in connection with which he brought in material on the sign language of the deaf and various aboriginal groups. Tylor did not, however, reëxamine the question of whether apes could acquire language. Alfred Russel Wallace, who had, working independently of Darwin, arrived at the theory of evolution through natural selection, entered the glottogonic controversy by way of a review of Tylor's book, Anthropology, in 1881. Here he advanced the theory of the origin of speech from mouth-gesture, which had in turn arisen from a prior gesture language based on hand and arm movements.

Wilhelm Wundt was perhaps the most illustrious psychological contributor to glottogonic theory around the turn of the century, although he did not relate his ideas to anthropoid apes. He wrote extensively on the gestural theory, however, in his monumental Völkerpsychologie, the last version of which appeared in 1922. Linkage of work on non-human primates and language research fell to the quixotic American investigator, Richard Lynch Garner, who was the first to attempt direct field observation of anthropoid apes in their natural habitat, and to employ the recently invented phonographic apparatus to record data on wild animal calls in the field. His arrangements included a large steel cage set out in the tropical rain-forest, in which he sat, notebook in hand, with wax-cylinder sound-recording facilities, waiting for the apes to approach the enclosure. Scientifically, Garner's effort was mostly a pathetic failure (cf. Apes and monkeys, their life and language, 1900). Jules Verne, the French science-fiction writer, normally friendly to far-fetched scientific undertakings, thought Garner quite mad, and ridiculed his project in one of his less famous books, Le village aérien, 1901 translated as The village in the treetops.

Although the early 20th century witnessed increasingly successful efforts to keep anthropoid apes alive in captivity, and even some cases of their maintenance in domestic surroundings, it was not until 1930 that a deliberate attempt was made to teach apes to talk. William H. Furness, III, worked for up to five years with a young orang-utan (he had also worked more briefly with chimpanzees), and by 1916 published his very meager results. By dint of daily, very repetitious

training, involving manual manipulation of the lips and mouth of the animal, Furness managed to elicit a few poorly articulated approximations of /papa/, /cup/, and /mama/ (Furness,1916:285). Furness' negative results seemed to settle the question of whether apes could acquire spoken language, at least. The now notorious fossil hoax of "Piltdown Man", announced to the scientific world in 1912, also contributed to the assumption of an immense evolutionary gap between man and the apes. This amazingly successful fake, not exposed until the early 1950's, combined a fully human cranium, and a very apelike lower jaw (as it turned out, it was in fact an ape's lower jaw!), indicating to several highly respected authorities on human evolution that the prime mover of hominization lay in the brain, probably involving the very early use of speech, thus greatly exaggerating the evolutionary gulf between hominids and pongids.

During the First World War, Robert M. Yerkes became interested in psychological research with anthropoid apes, which led to the founding of the first scientific center for such studies at Yale, later moved to Florida. During war-time internment on Teneriffe in the Canary Islands, the German Gestalt psychologist Wolfgang Köhler made his observations on an open-air chimpanzee colony (1918, English translation, 1925), and Nadia Kohts (Ladygina) began her work with the young chimpanzee Joni (1923,1925) in Moscow. These experimenters did not try to develop language in their subjects, but they contributed to expectations of its theoretical possibility. In 1925, R.M. Yerkes casually suggested that chimpanzees might be able to learn the sign language of the deaf. In the early 1930's, Winthrop Kellogg reported on the experimental raising of a young chimpanzee with his son (The ape and the child), in which the advantages of being human seemed to be related mostly to the child's propensity to acquire spoken language; on many other tasks, the ape was for a time superior. Not long after the end of World War II, Keith J. Hayes and Cathy Hayes undertook the home-raising of the chimpanzee Viki, in a deliberate project to inculcate spoken language (1950, 1951). Learning about this experiment when it was still under way, in mid-1951, I wrote to the Hayes, to suggest that a gestural language rather than speech might be more feasible for chimpanzees. At the time, I do not think I was aware of R.M . Yerkes' suggestion, but I cannot be sure. I wrote (Hewes to C. and K.J. Hayes, July 3, 1951), "In an ideal experimental situation, Viki should be exposed at least several hours a day, for many months at a minimum, to human companions who not only use conventional hand-arm gestures in dealing with her alone, but in conversing with each other ... Assistants who would be able to communicate with hand and arm gesture language could probably be obtained from among the deaf-mute population of this country." Keith Hayes replied at length (July 23, 1951), stating "we gave some thought to the question of manual sign language when we started the project. We decided

against it at the time, because we felt that Viki might have little interest in learning speech if she had another method of communication available. This would no longer be a factor, of course, and it might be worth trying now." Not long after that exchange of letters, Viki died, and Washoe rather than Viki became the pioneer member of her species to emloy gesture-language.

Anthropoid apes do not appear to use symbolic language in their natural state, in the forests. Until the early 1960's, however, such a negative statement could not have been documented. Only the small, non-pongid ape, the gibbon, had been carefully observed in the wild before that time, by C. S. Carpenter. Detailed field studies of Old World monkeys, in fact, did not really begin until the early 1950's, in Japan on the local stump-tailed macaque, and in Africa on baboons. Social communication was of course an important aspect of these investigations, with tape-recorders replacing the bulky disc apparatus previously available. Around the same time, the topic of possible language-like behavior, or language-acquisition capabilities was investigated in cetaceans - in porpoises and dolphins, notably by John C. Lilly and his colleagues. It was supposed for a time that these very large-brained aquatic mammals, known to employ a complex system of vocal signals, might either possess something of a language of their own, or prove to be capable of acquiring one from human trainers. It has been very difficult for speaking human beings to realize that the essence of language does not lie in some kind of vocal behavior.

The late 1960's saw the beginning of research on the reconstruction of the acoustic properties of fossil vocal tracts and their comparison with the vocal tracts and vocal production of monkeys, apes, and adult and newborn human subjects, by Philip Lieberman, Edmund Crelin, et al., at the Haskins Laboratories in Connecticut (cf. Lieberman, 1975). Articulate speech of human type, accord ing to these studies, was not only physically impossible for monkeys and anthropoid apes, but for certain early hominid fossil forms such as the Australopithecines, and although not impossible, would have been quite unlike any natural spoken language known, among the Neanderthalers. If these findings were true, articulate speech must be a relatively recent emergent among the hominids, which raises the question of what kind of language, if any, existed prior to articulate speech ?

It was in the midst of such considerations, in the late 1960's, that R. Allen and Beatrice T. Gardner, and quite independently, David Premack, began work on the elicitation of non-vocal language behavior in chimpanzees. As far as I know (and the Gardners may speak to this themselves), there was no intention on the part of these investigators to become involved with language-origin theories, and the Gardners at least were very careful not to claim that whatever it was that Washoe was doing was necessarily "language". However, it proved difficult to keep

glottogenesis from coming up in discussions about these experiments and their significance. In some circles, to be sure, the possibility that language might not be a strictly human monopoly was so disturbing that the only solution was to ignore the data. It was not to be expected that someone like the late Leslie White, who had for years been emphasizing the species-specific ability to "symbol" as the key to human culture and the science of "culurology" would abandon his theoretical position in the face of empirical evidence. The case of Suzanne K. Langer is more puzzling, since she exhibits a solid background in evolutionary biology in her erudite work, Mind: an essay on human feeling (1972,vol.2) and yet is able to adhere to an essentially Cartesian position. To be sure, she regards the work of even the most distinguished ethologists as "slipshod"(1972:108), and rejects that anything approaching language has been developed in chimpanzees (p.211), although paradoxically conceding that the Washoe experiment "was one of the greatest" ever made on the psychology of language. In a recent thesis and two papers, John H. Powers (1974,a,b,1975) upholds Langer's viewpoint in attacking the linguistic accomplishments of Washoe, Sarah, et al., although curiously he argues that if a chimpanzee could learn to handle the basic arithmetical operations of addition, subtraction, multiplication, and division, he would have to change his mind, inasmuch as numbers are "words of the highest conceptual purity". Such a test would disqualify a good many natural language systems around the world, in which arithmetical concepts are practically non-existent. Mistler-Lachman and R. Lachman (1974) advance some casuistic objections to the experiments by Rumbaugh, et al. and the chimpanzee Lana, in a similar vein, which I think Rumbaugh and Gill very successfully refuted.

Noam Chomsky's leadership in revision of some very basic linguistic theories, which began with his review of B. F. Skinner's behaviorist treatment of language in 1957, involved, as we have seen, a considerable revival of interest in 17th century Cartesian views about grammar and the supposed species-specificity of language. It was not accidental that Eric H. Lenneberg's Biological Foundations of Language (1967) has a long appendix by Chomsky on the formal properties of language, nor that all of these new views should have impinged on the interpretation of the Washoe and Sarah studies early in this decade.

Although opinion among linguists and neurolinguists remains divided on the question of language capacities of apes, William Orr Dingwall concluded at the 26th Annual Georgetown University Roundtable, devoted to developmental psycholinguistics, that the Gardners, Fouts, Premack, and Rumbaugh, et al. have indeed demonstrated to his satisfaction "types of nascent language abilities" in their chimpanzee subjects (Dingwall, i.p.,1975:19).

Is there a reason why chimpanzees should prove particularly apt learners of language-like behavior ? There has been a rapid growth of evidence in molecular biology of late, which tends to close the biological gap between man and chimpanzee, and widen it somewhat with respect to the other two pongids. In general, the biochemical evidence confirms older taxomic treatment of the Primate Order (Goodman,Morris, 1974), but man and chimpanzee are regarded by two investigators as "sibling species" (Mary-Claire King and A.C. Wilson, 1975:107 ff.). Zeno Cendler, commenting on Cartesian linguistics (1972:182) had remarked that "It is not an accident that the limits of mutual understanding /in language/ coincide with the limits of human cross-fertility." By a slight extension, it would appear that a close, common heredity may help to explain the linguistic showing of chimpanzees, and the apparent poorer performance of orang-utans. Unfortunately, the only experiment involving the gorilla does not seem to have been published so far. It is probably relevant that only the chimpanzee has been seen, under natural wild conditions, and in widely different parts of Africa, to make and use simple tools.

As Lenneberg made clear, human ability to use articulate speech does not depend on possession of a brain of normal dimensions. The so-called bird-headed human dwarfs, with brains about the size of gorillas (400-450 cc.) speak, even if the content of their discourse exhibits gross retardation. These dwarfs evidently retain, despite gross neuronal deficiencies, enough of the "language acquisition device" proposed by Chomsky to enable them to decode and encode human speech, and at least about as much general language competence as chimpanzees. We may then extrapolate to the fossil Australopithecines, two to four million years ago, who were bipedal in stance and gait, made some extremely simple stone tools, engaged in hunting or scavenging of large game on occasion, and possessed brains only slightly above the average for modern pongids (Jerison, 1973).
If the vocal tract studies of Lieberman and Crelin are at all valid, I think you can see where these points lead us: straight to early hominids with at least a rudimentary capacity for language, as in chimpanzees, so long as the language is not of a vocal-articulate character. To be sure, unlike Washoe, Sarah, Lucy, or Lana, there were no dedicated psychologists around to serve as the language-teachers for the Australopithecines. Whatever language they may have had, had to be of their own invention. If they did not, as seems reasonable, begin with "biologically dictated templates for language acquisition"(Rumbaugh and Gill, 1974), language must have been built upon a more general set of capacities, of the kind described for the higher primates by J.M. Warren (1974:445-454) - for acquisition of general abstract strategies and response rules, and at the same time, upon appropriate social behavior patterns. Moerk has observed that a con-

siderable degree of role-taking competence is related to language competence, underlying the ability to estimate the information needs of the intended receiver of a message (1974:252). The consummate social skills of the chimpanzees may thus have much to do with the linguistic success of chimpanzees, making it less likely that the far less sociable orang-utan and only moderately gregarious gorilla will be able to match chimpanzees as conversationalists. Bouwerman, in his chapter in a volume on the language of the mentally retarded (R. Schiefelbusch and L. L. Lloyd, eds., 1974) remarks that "language is only one manifestation of a very general ability to represent or symbolize experience". Nelson Goodman (1967:23-28), in an imaginary philosophical dialogue, has one of his characters say, "What we call a language is a fairly elaborate and sophisticated symbolic system. Don't you think, Jason [another character in the dialogue] that before anyone acquires a language, he has had an abundance of practice in developing and using rudimentary prelinguistic symbolic systems in which gestures and sensory perceptual occurrences of all sorts function as signs ?" Several recent investigators working with very young human infants have suggested that such prelinguistic symboling does take place, and that in environments where parents, because of profound deafness, communicate in gestural signs, propositional language may appear precociously, well in advance of the norms for speech acquisition.

Showing that man and chimpanzee possess somewhat similar language-handling capacities, although human beings eventually far outdistance chimpanzees in their language operations, does not explain either the evident failure of propositional language to emerge among apes, nor how man's language came to be mostly of the vocal-auditory variety, entailing specialized cortical adaptations for our ability to encode and decode speech sounds(cf. Dingwall, 1975:32). The gestural theory can provide only a partial explanation, as a path of least biological resistance from no language at all to a basic competence, and then perhaps as a kind of evolutionary template for the emergence of a sound-based language. If there was some kind of gestural stage in glottogenesis, it is most unlikely that the system bore a close resemblance to ASL(Ameslan) or, say, the sign languages of the North American Plains Indians or the aboriginal Australians. Just for the sake of argument, I would like to suggest that while it may have exhibited semanticity, productivity, and predication, it may have been virtually without the attribute of grammaticality.

Professor Stokoe may comment on the singular appropriateness of the Gardner's choice of Ameslan for their experiment. The language, as used in the deaf community in this country, has been the subject of competent linguistic analysis, and there are dictionaries and textbooks available, which still cannot be said for all of the natural spoken languages around the world. Unlike the ad hoc

language systems devised by Premack and by Rumbaugh, et al., something remotely like Ameslan, at least in its use of finger, hand, and arm gestures, could have played a part in glottogenesis. The survival, throughout modern mankind, of a wide range of finger, hand, and arm gestures as "paralanguage", or for cross-linguistic communication when speech fails, is another powerful advantage of working with manual gesture among pongids. There has been, so far, very little in the way of a model reconstruction of a hypothetical, early gesture-language. Eventually, if this theory is pursued, wem must address ourselves to that task. The only serious and at all extensive discussion along these lines is by the Hanoi philosopher (and Marxist), Trân Dûc Thâo, whose ideas I have found very stimulating (1973), and informed on the subject of the fossil remains and probable ecology of the protohominids. Trân's scheme for gestural glottogenesis begins with simple acts of pointing or deixis, something which apes do not do in the wild, as far as we know, although they seem able to learn it readily enough among human companions. The 17th century discussants of gesture-language assumed that such signing was understandable without previous training (Knowlson, 1965:502).

There is certainly not time here to bring up the matter of the striking lateralization of various functions in the human cerebral hemispheres, and its relation to language origins, gesture, or the apparent slight if any evidence for comparable cerebral lateralization in apes or other non-human primates. I must limit myself to observing that the normal marked left-hemisphere localiation of speech controls and language in man may have been built upon an antecedent left-lateralization of precision hand controls and kinaesthetic/ tactile feedback. The effort to determine just why the human brain has certain functions almost always on the left, and certain others on the right, remains to be explained evolutionarily.

Since most of you are not anthropologists or paleontologists, it is worth reminding you of the time framework within which hominization occurred, and how long the emergence of language may have taken. The consensus among students of human evolution today is that basically manlike forerunners of our species with bipedally adapted skeletons, manlike rather than apelike dentition, and capability for survival in more or less open savanna environments, were in existence three to four million years ago, and mostly if not altogether confined to the African continent. As we have seen, it is highly unlikely that they could use articulate vocal language. If, as I assume, they were capable of developing a rudimentary gestural language, this was probably extraordinarily slow, perhaps taking something on the order of two million years. It seems inescapable that factors in the environment and behavior of these protohominids provided survival advantages for even the most rudimentary use of deictic signs, above and beyond

the long-established uses of the vocal call system found generally in primates. By about one million years ago, or perhaps earlier if the East Rudolf specimen ER-1470 represents an early member of the new stage, considerably larger-brained honinids we call Homo erectus were on the scene, their range extended far beyond Africa into Central Europe, Indonesia, and North China. Jerison (1973) is convinced that Homo erectus, rather than the much more ape-like brained Australopithecines, represents a decisive evolutionary shift in humanness, and the Homo erectus use of fire (in a few areas) and well-fashioned hand-axes over much of the western half of the range, seem to confirm this. If the new cultural level level accounts for part of the increment in brain size, actually increasing the number of neurons in many parts of the cortex, advances in language may have been involved likewise. A further upswing in brain size occurred, however, starting about 350,000 or 400,000 years ago, in forms which Lieberman and Crelin feel probably possessed some articulate speech capacity. If so, I suspect that the principal pressures at the neuronal and cortical pathway level had to do with bringing language delivery and decoding speed into a closer conformity with what might be called general cognitive processing speed.

The Neanderthal populations of from about 100,000 to 50,000 years ago had large brains (in some specimens, larger than modern Homo sapiens sapiens averages), but may have not been capable of the full phonetic range of modern spoken languages, and hence perhaps slightly slower in speech transmission and decoding than modern speakers. Though practicing deliberate burial, sometimes with offerings, and perhaps some form of hunting ritual, the Mousterian culture of Neanderthal Man was markedly lacking in the decorative and representational "art" of the succeeding Upper Paleolithic cultures in the same region, when Neanderthal opulations were in some manner replaced by fully modern Homo sapiens sapiens. Numerous paleoanthropolgical investigators feel, but of course cannot prove, that the dramatic cultural upswing coinciding with the rapid wordlwide spread of fully modern mankind has something to do with fully modern forms of language. J. Desmond Clark (1975: 194,f.n. 5) does not hesitate to advance this explanation for what is a very familiar prehistoric problem. Mary L. Foster, an anthropological linguist, using standard comparative linguistic methods, has concluded that modern forms of spoken language go back to a "vanishing point" approximately 50,000 years ago (i.p.,1975). To be sure, some other linguists argue that statistical errors make any such linguistic reconstructions quite unreliable in the time range greater than ten millennia.

This takes us quite a long way from the chimpanzee language experiments, to be sure. I do not think that what has been accomplished so far represents most or all of what can be expected from linguistic research with these close relatives of man. Among other things, all of the studies to date have been undertaken by

English-speaking investigators, using languages, whether gestural or otherwise, do not depart drastically from standard Indo-European format. Will chimpanzees prove to be equally adept at responding to language-systems structured along the lines of Eskimo or Navaho, Bantu or Kabardian ? On another tack, if, as Fouts has reported, chimpanzees exhibit some receptive capacity for spoken English, despite an inability to respond in kind, the way is opened up for numerous experiments on the relative efficiency of phonological systems. If someone is willing to construct gestural language systems more in keeping with what we imagine the way of life of very early man to have been, these too could be compared to modern sign languages such as Ameslan, or the sign languages generated by profoundly deaf people in isolated communities, one of which was recently described by Rolf Kuschel. While primates other than pongids may be poor candidates for language experiments, dogs may have been seriously neglected. What they may lack in cognitive capacity compared to apes, or in manipulatory skill, they make up for in willingness to work long and hard for humans, and some adaptation of the computer-language apparatus devised for Lana might be usable with dogs. Their well-known responsiveness to human speech suggests that instead of visual signs, a system of speech-like sounds might be employed.

In closing, I strongly recommend that this whole line of research be very strongly encouraged, and greatly expanded. There are various practical applications, particularly relating to ways of improving the language capacities of the severely retarded, a substantial percentage of whom communicate gesturally in institutional settings. But I think there are far more interesting things which the study of language behavior in non-human animals may tell us about our own species and our peculiar place in nature.

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